

U.S. Patent Application Serial No. 09/660,439

a trench provided such that it extends from a surface of said conductive region to said drain layer;

a source region of the first conductivity type provided inner surface of said conductive region and exposed on side surface of said trench;

*c1
cnel.* a gate insulating film provided on the side surface of said trench, an upper part of the gate insulating film being in contact with a lower part of said source region, a bottom part being in contact with an upper part of said drain layer, and a middle part being in contact with conductive region;

a gate electrode material provided in contact with said gate insulating film in said trench;

a source electrode film provided in contact with at least said source region exposed at least on the side surface of said trench and electrically insulated from said gate electrode material, said source region being substantially square when viewed from a direction parallel to said side surface of said trench, said source electrode film being contiguous and extending from an upper portion of said source region and a side surface of said source region, said contiguous source electrode film covering an opening of said trench in its entirety.

11. (Twice Amended) A transistor comprising:

c2 a semiconductor substrate having a drain layer of a first conductivity type and a conductive region of a second conductivity type formed by diffusing an impurity of the second conductivity type from a surface of said drain layer;

a trench provided such that it extends from a surface of said conductive region to said drain layer;

a source region of the first conductivity type provided in inner surface of said conductive region and exposed on side surface of said trench;

c2
cont'd.
a gate insulating film provided on the side surface of said trench, an upper part of the gate insulating film being in contact with a lower part of said source region, a bottom part being in contact with an upper part of said drain layer, and a middle part being in contact with said conductive region;

a gate electrode material provided in contact with said gate insulating film in said trench;

a source electrode film provided in contact with said source region exposed at least on the side surface of said trench and electrically insulated from said gate electrode material, said source electrode film being contiguous and extending from an upper portion of said source region and a side surface of said source region, said contiguous source electrode film covering an opening of said trench in its entirety,

said source region being substantially square when viewed from a direction parallel to said side surface of said trench; and

a metal film formed on a surface of said drain layer opposite to said conductive region to establish Schottky contact with said drain layer.

Add claims 20 and 21 as follows:

20. A transistor comprising:

a semiconductor substrate having a semiconductor layer, a drain layer of a first conductivity type provided on said semiconductor layer and a conductive region of a second conductivity type formed by diffusing an impurity of the second conductivity type from a surface of said drain layer;

C3
a plurality of trenches, each of said plurality of trenches being provided such that it extends from a surface of said conductive region to said drain layer;

a source region of the first conductivity type provided inner surface of said conductive region and exposed on side surface of said trench;

a gate insulating film provided on the side surface of said trench, an upper part of the gate insulating film being in contact with a lower part of said source region, a bottom part being in contact with an upper part of said drain layer, and a middle part being in contact with conductive region;

a gate electrode material provided in contact with said gate insulating film in said trench;

a source electrode film provided in contact with at least said source region exposed at least on the side surface of said trench and electrically insulated from said gate electrode material, said source region being substantially square when viewed from a direction parallel to said side surface

of said trench, said source electrode film being contiguous and extending from an upper portion of said source region and a side surface of said source region, said contiguous source electrode film covering a plurality of openings of said trenches in their entireties.

21. A transistor comprising:

*C'X
cont*
a semiconductor substrate having a drain layer of a first conductivity type and a conductive region of a second conductivity type formed by diffusing an impurity of the second conductivity type from a surface of said drain layer;

a plurality of trenches, each of said plurality of trenches being provided such that it extends from a surface of said conductive region to said drain layer;

a source region of the first conductivity type provided in inner surface of said conductive region and exposed on side surface of said trench;

a gate insulating film provided on the side surface of said trench, an upper part of the gate insulating film being in contact with a lower part of said source region, a bottom part being in contact with an upper part of said drain layer, and a middle part being in contact with said conductive region;

a gate electrode material provided in contact with said gate insulating film in said trench;

a source electrode film provided in contact with said source region exposed at least on the side surface of said trench and electrically insulated from said gate electrode material, said source electrode film being contiguous and extending from an upper portion of said source region and a side

U.S. Patent Application Serial No. 09/660,439

surface of said source region, said contiguous source electrode film covering a plurality of openings
of said trenches in their entireties,

*C7
cont.*
said source region being substantially square when viewed from a direction parallel to said
side surface of said trench; and

a metal film formed on a surface of said drain layer opposite to said conductive region to
establish Schottky contact with said drain layer.